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ABSTRACT

This study investigated learners' preconceptions of interactive video (IV), instructional television (ITV), and television (TV), and compared three treatment groups on learners' perceptions of invested mental effort and achievement on a test of recall and inference. The three treatments consisted of an IV lesson that included practice questions requiring an active response, an ITV lesson that included practice questions requiring a covert response, and a TV lesson that did not include practice questions. The relationship between learners' preconceptions and perceived mental effort was also investigated. The subjects were 78 undergraduate students who were randomly selected and assigned to the three treatments, and a posttest only control group design was used. The independent variable consisted of the video-based instructional materials, and the dependent variables were student ratings of perceived mental effort, recall scores, and inference scores. Information on student preconceptions of the difficulty of learning from IV, ITV, and TV was also collected for descriptive and correlational purposes. Several statistical tests of significance were used to analyze the data, including analysis of variance (ANOVA), Tukey's Honestly Significant Difference (HSD) test, and Pearson's test of correlation. The results of the study indicate that learners who are required to actively respond to practice questions that are embedded in a video-based lesson recall significantly more information from the lesson than learners who are not provided with practice questions. It is suggested that, although the inclusion of such questions does increase the amount of factual information recalled, higher level practice questions may be needed to increase the number of inferences generated in response to a video-based lesson. (21 references) (BBM)

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Title:

Can Interactive Video Overcome the "Couch Potato" Syndrome?

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Can Interactive Video Overcome the "Couch Potato" Syndrome?

Current liteature abounds with the promises of inteactive video for revolutionaizing the instructional process. Although DeBloois (1982) contended that interactive video is an entirely new medium with characteristics quite unlike those of computers and video, recommendations for design and implementation of interactive video are often based on past televsion and computer research (see for example: Hannafin, Garhart, Rieber, & Phillips,1985).

Salomon (1983; 1984; Salomon & Leigh, 1984) conducted several influential studies on learning from television, and references to his findings are prevalent in the literature on interactive video. In the most frequently cited study, Salomon (1984) measured learners' preconceptions of the ease or difficulty of print and television, then the learners received either a print-based or video-based lesson. Upon completion of the lesson, learners completed a questionnaire on their perceptions of the amount of mental effort that they invested in the learning task, and were then given an achievement test. Salomon found that students perceived television as easier than print. Learners in the print condition reported investing more mental effort and had higher achievement scores than students who received the video lesson. Salomon concluded that the learners' preconception of television as a easy medium resulted in a decreased investment of mental effort and, consequently, lower achievement scores.

Several authors (Dalton,1986; Hannafin, et al, 1985; Schaffer and Hannafin,1986) have suggested that the active response required by interactive video lessons may overcome learners' preconceptions of television as a easy, passive medium, and result in increased mental effort and achievement. But although the results of Salomon's studies with linear video have been freely generalized to interactive video research and design, there is little research that has explicitly examined learners' preconceptions of interactive video.

A review of cognitive and motivational theory indicates that learners' scripts (Schank & Ableson, 1977), schemata, attributions (Weiner, 1979) and curiosity (Berlyne, 1960) may influence their preconceptions of a medium. Further examination of the literature suggests that learners' preconceptions may be influenced by their past experiences (Schank & Ableson, 1977), their perceptions of the learning task (Krendl & Watkins, 1983; Salomon & Leigh, 1984; Weiner, 1979), and the characteristics of the medium (Berlyne, 1960).

The characteristics of the medium can be manipulated easily in order to alter the learner's preconceptions of a mediated lesson and increase the mental effort that learners invest in processing the lesson. Several researchers (see for example: Dalton & Hannifin, 1987; Heestand, 1980; Lietke & Gall, 1985) have included practice questions in video-based materials and found that actively responding to embedded questions resulted in greater achievement scores than viewing a video-tape without practice questions. Anderson and Biddle (1975) reviewed the literature on practice questions in film, lecture, and text and concluded that practice questions seemed to faciliate the accquisition of both practiced and incidental information.

Although no researchers have included practice questions in video-based materials and examined the effects on students' perceptions of mental effort, several researchers (Britton, Piha, Davis, & Wehausen, 1978; Burton, Niles &

Lalik, 1986; Reynolds & Anderson, 1982) have included practice questions in text materials and found that practice questions may have increased the amount of mental effort used in processing the lesson.

Purpose of the Study

The purpose of this presentation is to summarize the results of a study that (a) investigated learners' preconceptions of interactive video (IV), instructional television (ITV), and television (TV), and (b) compared three treatment groups on learners' perceptions of invested mental effort and achievement on a test of recall and inference. The three treatments consisted of an IV lesson that included practice questions requiring an active response, an ITV lesson that included practice questions requiring a covert response, and a TV lesson that did not include practice questions. The relationship between learners' preconceptions and perceived mental effort was also investigated.

Research Hypotheses

The primary assumptions of the current study were based upon Salomon's (1983; 1984; Salomon & Leigh, 1984) findings that (a) television is perceived as easy, (b) there is a negative correlation between preconceptions of the ease of a medium and the amount of perceived mental effort, and (c) perceived mental effort is positively correlated with achievement on a test of inference items.

These primary assumptions were further developed based on a review of the related literature and the following expectations were generated: (a) Learners would perceive IV to be more difficult than ITV and TV, and learners would perceive ITV to be more difficult than TV; (b) learners would report expending greater mental effort in processing an IV lesson than in processing an ITV lesson or a TV lesson, and learners would report expending greater mental effort in processing an ITV lesson than in processing a TV lesson; (c) there would be a significant positive correlation between the perceived difficulty level of the video treatments and learners' self-reports of the amount of mental effort invested in processing the lesson using that medium; (d) learners who received the IV lesson would have higher scores on a posttest of inferences than learners who received the ITV lesson and the TV lesson, and learners who received the ITV lesson would have higher scores on a posttest of inferences than learners who received the TV lesson; (e) there would be no significant difference in the recall scores of learners who received an IV lesson, an ITV lesson, or a TV lesson; (f) there would be a significant positive correlation between learners' estimates of mental effort and achievement scores on a test of inference items.

Method

A posttest-only control group design was used for this study. The independent variable consisted of the video-based instructional materials with three levels (IV vs ITV vs TV). The students who received the IV treatment were provided with active practice, the students who received the ITV treatment were provided with covert practice, and the students who received the TV treatment were provided with no practice.

The dependent variables consisted of student ratings of perceived mental effort, recall scores, and inference scores. Information on student

preconceptions of the difficulty of learning from IV, ITV, and TV was also collected for descriptive and correlational purposes.

It was assumed that random assignment controlled for differences in prior knowledge; however, a pretest was administered to a cohort group. The pretest confirmed that the target population did not have extensive prior knowledge of the content of the lesson: The mean score on a combined test of recall and inference items was 4.3 points out of a possible 60 points.

Participants

Seventy-eight undergraduate students were randomly selected and assigned to the three treatments; however, the final sample consisted of 23 students in the IV group, 25 students in the ITV group, and 23 students in the TV group due to attrition.

Instructional Materials

The instructional materials consisted of a TV lesson, an ITV lesson, and an IV lesson of approximately 20 minutes in length. Segments from an existing interactive video science unit on the topic of fission and fusion were modified for use in this study. The instructional strategy followed the events of instruction outlined by Gagné and Briggs (1979) and was similar for each treatment.

The manner in which the events of practice and feedback were presented in the three lessons constituted the primary difference among the three treatments. Conventional television programs typically do not provide practice and feedback on the concept presented in the program (Smith & Andrews, 1985); therefore, the TV treatment did not contain any form of practice and feedback. Although both the IV lesson and the ITV treatment included practice and feedback, learners were required to overtly respond to practice questions in the IV lesson, but were only given the opportunity to covertly respond to the practice questions in the ITV lesson.

Following the presentation of information for each objective (verbal information: recall and inference), the learners in the IV and ITV treatments were presented with a text screen that asked them to identify all statements that were true about the topic previously presented. In the IV treatment, students were required to touch all of the correct phrases and their responses were followed by "knowledge of response" feedback. In the ITV treatment, practice questions were followed by an extended pause and the students were expected to respond covertly. In both the IV and ITV treatments, each text screen that contained a practice question was followed by a text screen that provided the correct answers. The feedback in the IV lesson remained on the screen until the learners touched the screen to continue the presentation; the feedback in the ITV lesson was followed by an extended pause.

Collected Data

Preconceptions of difficulty. A preconceptions questionnaire was administered immediately prior to the lesson to assess students' preconceptions of the difficulty of IV, ITV, and TV. The questions were identical to those used by Salomon (1984) to measure student preconceptions of print and television except for the subsitution of the words "interactive video", "instructional television", and "television" in place of "television" and "a book". To ensure that each of the participants interpreted the terms "interactive video", "instructional

television", and "television" in the same manner, the terms were operationally defined.

Students were asked to rate their responses to questions such as " How easy would it be for you to learn to solve a math problem from interactive video?" on a 5-point Likert scale. One represented "very easy" and five represented "very difficult". There were three questions for each medium, and in accordance with Salomon's methodology, the scores on the three items for each medium were added together to result in an overall score for TV, an overall score for ITV, and an overall score for IV.

Although Salomon reported a Cronbach's alpha of .89 for his questionnaire, in the current study, the Cronbach's alpha was .75. However, the questionnaire was assumed to have an acceptable degree of internal consistency for the purposes of this study.

Mental effort. After completing the instructional materials, students were given a brief questionnaire which asked them to estimate the amount of mental effort that they had invested in processing the lesson. The questionnaire consisted of six questions that were derived by combining the questions that Salomon used in two studies (1983; 1984). Students were asked to rate their responses to questions such as "How hard did you concentrate while watching the lesson?". Students responded on a five point scale of effort with 1 representing "low" and 5 representing "high". Responses to each item were added together to provide a total score for each student. An analysis of the internal consistency of the instrument used in this study resulted in a Cronbach's alpha of .55.

Achievement measures. Cued recall and cued inference questions were included in the achievement measure. The questions required constructed responses that ranged in length from one sentence to several paragraphs. Student responses were scored as to the number of correct facts or ideas that they generated in response to the questions.

The recall items consisted of eight cued recall questions pertaining to explicitly presented verbal information. The test of inferences consisted of seven open-ended questions. Responses to the inference questions could include information that was explicitly stated in the lesson as well as inferences that connected ideas that were explicitly presented in the lesson. Responses that restated information that was explicitly presented in the lesson were coded as "recall"; responses that connected ideas that were stated in the lesson were coded as "inferences". Each student received a recall score that reflected the total number of facts that were correctly recalled in response to the recall and inference questions (maximum possible recall score = 45) and an inference score that reflected the total number of inferences generated in response to the inference questions (maximum possible inference score = 18).

Using the scoring key, an acceptable interrater reliability of .95 was achieved among the researcher and three graduate students in instructional technology.

Additional data collected. In addition to collecting data that was essential to the measurement of the dependent variables, students were asked to record the time when they began the lesson and when they completed the lesson. The time at which the student began the lesson was subtracted from the time at which the student ended the lesson to result in a lesson time score.

Procedures

Upon reporting to the research site, students were expected to complete the treatment independently and with a minimum of supervision. The experimental packet contained general instructions on how to proceed through the lesson, instructions on the operation of the equipment, and all treatment materials. First, the participants completed the preconceptions questionnaire, then they received instructions to proceed to the IV table, the ITV table or the TV table, depending on the student's assigned treatment. After students completed the lesson, they were instructed to complete the questionnaire on mental effort. After completing this questionnaire, the students were asked to complete the posttest of recall and inference items.

Results

The data were analyzed using several statistical tests of significance. Analysis of variance (ANOVA) was used to analyze the data among groupus on perceived mental effort ratings, recall scores, and inference scores. A repeated measures ANOVA was used to determine if there were significant differences among learners' preconceptions ratings for IV, ITV, and TV. This test was used to analyze the preconceptions data because ratings for each of the three media were obtained from each participant, thus the ratings were highly correlated. Following a finding of a significant F, Tukey's Honestly Significant Difference (HSD) test was used to determine the significant differences among individual group means. Correlations among scores on the measurement instruments were tested using a Pearson's r test of correlation.

Preconceptions of Difficulty

Out of a maximum possible difficulty rating of 15 for each medium, the mean rating for IV was 5.47, the mean rating for ITV was 6.21, and the mean rating for TV was 7.90.

A repeated measures ANOVA indicated that there was a significant difference in the learners' preconceptions of the difficulty of IV, ITV, and TV, $F(2,140) = 48.43$, $p < .01$. A Tukey's HSD post-hoc analysis ($p < .05$) of the data indicated that learners felt that it was significantly easier to learn from IV than from ITV and TV, and significantly easier to learn from ITV than from TV.

Perceived Mental Effort

Out of a maximum possible perceived mental effort rating of 30, the mean rating for IV was 20.56, the mean rating for ITV was 21.04, and the mean rating for TV was 20.00. ANOVA results indicated there were no significant differences in the learners' perceived mental effort ratings between treatments, $F(2,68) = .69$, $p = .51$.

Preconceptions of Difficulty and Perceived Mental Effort

Pearson's r test for correlation indicated that the correlation between the mean preconceptions ratings and mean perceived mental effort ratings did not reach significance for IV, $r = -.31$, ITV, $r = -.13$, or TV, $r = -.07$.

Inference Scores

The maximum possible inference score was 18 and the mean score for IV was 5.04, the mean score for ITV was 4.60, and the mean score for TV was 4.47. ANOVA results indicated that there were no significant differences between the mean inference scores of the three groups, $F(2,68) = .27$, $p = .76$; however the mean inference scores were in the predicted order (IV > ITV > TV).

Recall Scores

The maximum possible recall score was 45 and the mean score for IV was 20.4, the mean score for ITV was 18.6, and the mean score for TV was 15.5. ANOVA results indicated that there were significant differences between the mean recall scores of the three groups, $F(2,68) = 4.59$, $p = .01$. Tukey's HSD test for post-hoc analysis indicated that the learners who received the IV lesson recalled significantly more information from the lesson than learners who received the TV lesson. There was no significant difference between the mean recall scores of the learners who received the ITV lesson and the mean recall scores of the other two groups.

Mental Effort and Inference Scores

The Pearson's r test for correlation indicated there was a significant correlation between the mean perceived mental effort ratings and mean inference scores, $r = .27$, $p = .012$.

Post-hoc Analyses

Several post-hoc analyses were conducted in order to explore possible explanations for the results of the primary analyses.

Perceived mental effort ratings and recall scores. The results of the Pearson's r test of correlation revealed that there was a significant correlation between the learners' perceived mental effort ratings and their recall scores, $r = .33$, $p = .01$.

Lesson time. The data on lesson time were analyzed to determine if there were significant differences among treatment groups and to determine if there was a significant correlation between lesson time and inference scores or recall scores. ANOVA results indicated a significant difference between the three treatment groups in the amount of time that was required to complete the lesson, $F(2,68) = 8.66$, $p = .0004$. Further analysis using Tukey's test revealed that the IV ($M = 25.3$ minutes) and ITV ($M = 23.2$ minutes) groups took significantly longer to complete the lesson than the TV group ($M = 18.5$ minutes). However, there was not a significant correlation between reported lesson times and learners' recall scores, $r = .16$, or inference scores, $r = -0.02$.

Discussion

The purpose of this study was to investigate learners' preconceptions of the difficulty of interactive video (IV), instructional television (ITV), and television (TV) and to examine the effects of responding actively or covertly to practice questions embedded in video-based materials on perceived mental effort and achievement on a test of recall and inference items.

Preconceptions of Difficulty

This study was based on the premise that preconceptions of a medium influence the amount of mental effort that learners invest in processing a mediated lesson. The present study assessed learners' preconceptions of the difficulty of IV, ITV, and TV.

Although it was predicted that adult learners would perceive IV as more difficult than ITV and TV, and ITV as more difficult than TV, the results were in the opposite order. The learners perceived that it was significantly easier to learn from IV than from ITV and TV, and significantly easier to learn from ITV than from TV.

The differences between these findings and the results of Krendl's (1986) and Salomon's (1983, 1984; Salomon & Leigh, 1984) studies upon which the predictions were based may be due to the differences in the samples examined by the researchers. Salomon's samples consisted of public school students in grade six and Krendl's sample consisted of public school students in grades three through ten; however, the participants in the current study were undergraduate education majors from a select institution with stringent admission requirements. Due to the past academic successes of the learners in the sample examined in the current study, it is probable that they had more well-developed schemata relative to the learning process than the majority of students who are enrolled in public elementary or secondary schools.

Although the learners who participated in the current study perceived that it was easier to learn from interactive video than from television, this finding does not necessarily mean that the learners perceived interactive video as "easy". College students such as the ones included in this sample may be aware that an "easy" lesson is not necessarily easy to "learn from".

The pattern of means on the inference and recall test tended to support the learners' preconceptions of the difficulty of learning from the media utilized in this study: Although the differences among groups was not significant, the recall and inference scores tended to be higher for IV than for ITV and TV, and higher for ITV than for TV. In general, the more difficult it was perceived to be to learn from a medium, the lower the inference and recall scores of the learners who received a lesson using that medium.

These findings were opposite from the results reported by Salomon (1983; 1984; Salomon & Leigh, 1984): Salomon found that learners scored higher on a test of inference when leaning from a medium that was perceived as difficult (print) than from a medium that was perceived as easy (television).

Although information as to why the learners perceived one medium as easier or more difficult than another was not collected, the results indicate that the learners did perceive IV, ITV, and TV as very different in their ability to facilitate learning. Future research that examines the learners' rationale for rating one medium as easier or more difficult than another may provide information on the extent to which learners are aware of their own cognitive strategies for learning. In addition, studies that are similar to the current study should be conducted with other age groups and aptitude levels to determine to what extent preconceptions are a function of the age and aptitude of the learners.

Relationship of Preconceptions of Difficulty to Mental Effort

It was predicted that there would be a significant positive correlation between learners' preconceptions of the difficulty of a medium and their

perceived mental effort ratings when learning from that medium; however, the predicated correlation did not occur.

The lack of a significant correlation between preconceptions of difficulty and perceived mental effort may have been due to the limitations of the measurement instruments. In particular, the low reliability of the perceived mental effort questionnaire may have masked potential results.

The lack of the predicted correlation also may have been due to the learners' interpretation of the questions on the two questionnaires. Whereas the preconceptions questionnaire was designed to assess the learners' general preconceptions of the difficulty of learning from a medium, the mental effort questionnaire was designed to assess the amount of mental effort that the learners perceived that they had invested in learning their specific assigned lesson. The preconceptions questionnaire required the learners to rate the difficulty of learning several tasks from each medium; the mental effort questionnaire required the learners to rate how hard they tried to understand the lesson, how hard they concentrated, how hard the lesson was to understand, how much the lesson made them think, how much they thought they could remember, and how much effort they used in comprehending the lesson. It is possible the amount of perceived effort required to understand, concentrate, think, and comprehend were not major factors that learners considered as they reported their preconceptions of the difficulty of learning from a medium.

Future researchers should use mental effort questionnaires and preconceptions questionnaires that are closely aligned in wording in order to provide insight on the role of preconceptions in the amount of mental effort invested in processing a lesson. For example, the perceived mental effort questionnaire used in this study asked the learners "How hard did you try to understand the lesson?"; a preconceptions questionnaire could be designed to access a similar construct by asking "How hard do you usually try to understand a television lesson?".

Perceived Mental Effort, Recall, and Inference

It was expected that altering the typical characteristics of video-based materials through the addition of practice questions requiring an overt (IV) or covert (ITV) response would overcome learners' preconceptions of TV as a passive medium requiring little mental effort; therefore, they would engage in actively processing the content, perceive that they were investing a large amount of mental effort, and achieve high scores on a test of inference items.

Although the manipulation of the characteristics of the medium did not affect the learners' perceived mental effort ratings or inference scores, it had a significant effect on the learners' recall scores. The data analyses indicated that the learners who received the IV lesson that required an active response recalled significantly more information from the lesson on a test of recall than learners who received the TV lesson that did not require a response. Actively responding to the practice questions in the IV lesson did not result in significantly greater recall scores than covertly responding to the questions in the ITV lesson, and covertly responding to the practice questions in the ITV lesson did not result in significantly greater recall scores than viewing the TV lesson without practice questions.

These results were not consistent with the predictions, but upon closer examination of the learning task, the results do not seem surprising. In the current study, the learners received practice questions at the verbal recall

level, hence they were provided with direct practice toward the recall posttest. The practice questions were designed to ensure that the learners possessed the factual knowledge that was necessary for the generation of inferences. The learners were expected to connect the individual facts to create new inferences; however, they did not receive practice in the connection of the facts.

Several researchers (Heestand, 1985; Lietke & Gall, 1985) have found that factual postquestions facilitated the recall of the practiced information, but had no significant effect on the recall of information that was not practiced. Other researchers (Dalton & Hannafin, 1987; Lietke & Gall, 1985) have suggested that it is difficult to teach higher-level cognitive skills through the use of lower-level questioning strategies. It is possible that the recall practice questions may have caused the learners to focus on the rehearsal of the verbal information rather than on the elaboration of the content.

The fact that learners in the IV group reported significantly longer lesson times than the learners in the TV group may be offered as an alternative hypothesis to explain the results. But although there was a significant difference among the three treatments in the time spent on the lesson, there was not a significant correlation between reported lesson-time and recall scores. These results suggest that the differences in the recall scores of the IV group and the TV group were not entirely due to the greater amount of time spent on the lesson by the learners in the IV group.

The results of this study indicate that learners who are required to actively respond to practice questions that are embedded in a video-based lesson recall significantly more information from a video-based lesson than learners who are not provided with practice questions. The results also indicate that the inclusion of practice questions at the verbal recall level may not result in significant increases in the inferences generated in response to a video-based lesson.

However, the compressed range of the inference scores may have masked potential differences among the treatment groups. Out of 18 possible inferences, the mean of the IV group was 5.04, the mean of the ITV group was 4.60, and the mean of the TV group was 4.47. The type of practice question utilized in this study may have inhibited the generation of inferences, however, the compressed range of scores may also have been due to the difficulty of the scientific content for the non-science majors that participated in the current study.

Future researchers should continue to investigate the effects of practice questions with other types of practice questions, other types of objectives, and other groups of learners. Research that incorporates recall test items that are not directly matched to the practice questions may provide valuable insight as to whether increased recall scores are influenced by the direct rehearsal of the information that is included on the posttest or by a general review of the information that precedes the question. The effect of practice questions at higher-levels of cognitive processing seems to be an especially promising area for further research. It is possible that providing learners with practice questions at the inference level would result in the generation of a larger number of inferences than was observed in the current study. The effect of practice questions on the achievement of higher levels of learning outcomes such as intellectual skills or applications also seems to be a promising area for further research. Research with learners of different ages, aptitudes, and motivational levels than were used in the current study may strengthen the findings and increase the generalizability of the results.

Consistent with the predictions, a modest significant correlation was found between the learners' mean inference scores and mean perceived mental effort ratings. The post-hoc analyses indicated there was also a modest significant correlation between the learners' perceived mental effort ratings and their recall scores. As learners' perceived mental effort increased, their recall and inference scores also increased.

But although it was predicted that learners would perceive that they invested more mental effort in processing the IV lesson than in processing the ITV lesson and TV lesson, and that learners would perceive that they invested more mental effort in processing an ITV lesson than in processing a TV lesson, there was no significant difference between the three groups.

The prediction was based on the results of research studies (Britton, Piha, Davis, & Wehausen, 1978; Burton, Niles & Lalik, 1986; Reynolds & Anderson, 1982) that found the amount of cognitive capacity usage, as measured by a secondary task technique, increased when practice questions were embedded in text-based lessons. Although cognitive capacity usage and mental effort have been operationally defined in a similar manner by Salomon (1981), it is possible that the self-report measure used in the current study was not as sensitive to increases in mental processing as the secondary task measures that were used in the text-based studies, and in fact, may not have actually assessed the same cognitive processes.

The low reliability of the perceived mental effort questionnaire (Cronbach's alpha = .55) indicates that future researchers should use a different method of assessing perceived mental effort. The use of secondary task technique to assess cognitive capacity usage when learning from video-based materials may help determine if the inclusion of practice questions affects the amount of mental effort invested in processing video-based instruction and text-based instruction in a similar manner.

Conclusions

The conclusions of this study support the current practice of including practice questions requiring an active response in the design of interactive video instructional materials. The results suggest that responding actively to practice questions at the verbal recall level will increase the amount of information recalled from a video-based lesson that is designed to teach factual information at the verbal recall level. However, it appears that responding actively to practice questions at the verbal recall level will not increase the number of inferences generated in response to a video-based lesson. These findings suggest that video-based lessons designed to teach more than simple recall may need to include higher-level practice questions in order to increase the amount of information learned from the lesson. The results suggest that additional research is needed on the effects of actively and covertly responding to practice questions in video-based lessons.

Additional research also is needed on ways that different media are perceived. It has been suggested that preconceptions of media may vary depending in the age and aptitude of the learner.

Further research that examines learners' preconceptions of media and the ways that preconceptions can be altered to result in increased mental effort may be able to provide valuable information that may result in more effectively designed video-based lessons.

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